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VOLUME V.] FOR THE WEEK ENDING FEBRUARY 14, 1835. [NUMBER 2.

YOULDON'S IMPROVEMENTS IN CURING SMOKY CHIMNEYS.

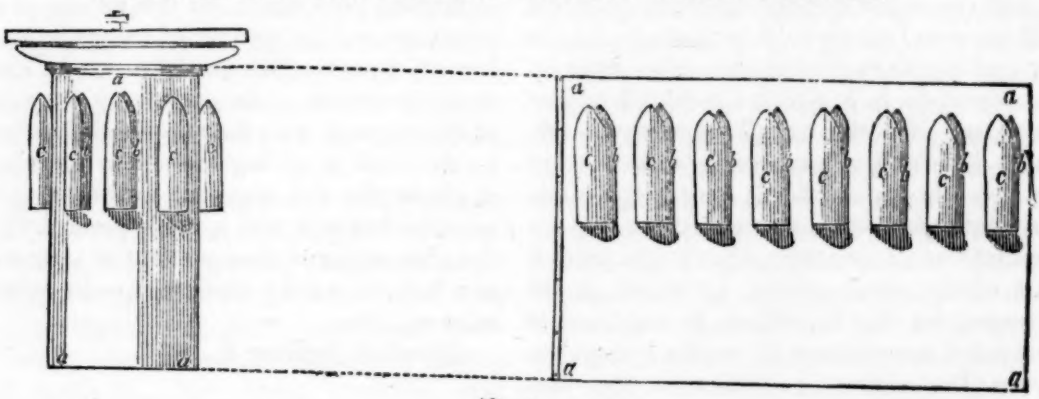

Fig 2.

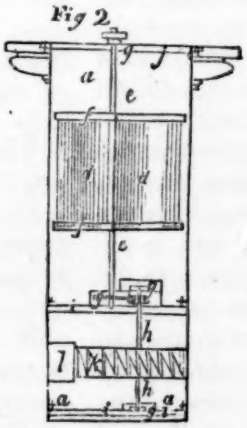

Fig. 3

Fig 4

[From the Repertory of Patent Inventions.]

Specification of the Patent granted to EDMUND YOULDON, *of Exmouth, Schoolmaster, for Improvements in Preventing or Curing what are termed Smoky Chimneys.*—Sealed August 5, 1834.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Edmund Youldon, do hereby declare the nature of my said invention and the manner in which the same is to be performed are fully described and ascertained in and by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon (that is to say):

Description of the Drawing.

Fig. 1, represents an apparatus constructed according to my improvements.

Fig. 2, is a vertical section thereof.

Fig. 3, is a transverse section thereof: and

Figs. 4 and 5, show detached parts of the same. In each of these figures the same letters of reference indicate similar parts, *a*, being the outer casing of zinc or other suitable material. *b*, *b*, are openings formed for the passage of air and smoke: these openings are covered in one direction, by the curved plates or wind-guards, *c*, *c*, the object of which will be hereafter described. *d*, *d*, are four curved vanes affixed to the axis or shaft, *e*; these curved

vanes are also affixed to the hoops or stays, *f*, *f*, for the purpose of keeping them in their proper positions as shown in the drawing. The shaft or axis, *e*, turns in bearings at *g*, *g*, there being a box or cover to prevent the smoke or dirt getting to the point of bearing. On the axis, *e*, is affixed a toothed wheel which takes into and drives the pinion on the shaft, *h*, which also turns in bearings at the points, *g*, *g*, as shown in the drawing, these bearings being supported by the cross framings, *i*, within the casing, *a*, and the upper one by the cover, *j*, for it will be seen that there is no passage for the air and smoke to pass at top, other than by the openings, *b*, *b*, which I prefer should be the case. On the axis, *h*, is affixed a circular fan or wheel, *k*, shown separately at fig. 4: this circular fan is constructed similarly to those used for smoke-jacks and for ventilators. *l*, is a stop which fills up that part of the outer casing, *a*, which is not occupied by the fan-wheel, *k*, and thus is prevented the passage of smoke except between the vanes or spokes of the fan-wheel, *k*.

Fig. 5, represents a plate of zinc, which is the material I commonly use, but do not confine myself thereto, as any other suitable material may be employed. This plate of zinc has eight openings, *b*, formed therein, whilst the part of the metal which is cut to form the opening is curved, as shown in the drawings, and thus form wind-guards to the openings, by which the wind is prevented entering such openings, except in certain directions, by which means only about three of the openings will be open to receive the wind, whilst the other openings may be said to be the tail-part of the mill, through which the wind that actuates the vanes, *d*, *d*, will again pass off, carrying with it any smoke which may be in the upper part of the apparatus.

Having thus described the various parts of the apparatus, I would remark, that it will be evident that the wind, in whatever direction it may blow, will be entering some of the openings, *b*, and thereby actuating the vanes, *d*, and cause the axis, *e*, to turn, and by the wheel-work give an increased motion to the fan-wheel, *k*, on the axis, *h*, and the vanes being set in a proper direction, will by its rapid revolution create an exhaustion below and a consequent draft to the chimney on which this apparatus is fixed. I would also remark, that I am aware that fan-wheels have been before used similar to the one I have described for producing a draft in chimneys; I do not therefore claim the production of a draft by such means, and it will be desirable to state that I do not lay claim to any of the parts separately, nor do I confine myself to having two shafts for the vanes, *d*, and the fan, *k*, as it will be evident that they may be both attached to one, though I prefer that the fan-wheel, *k*, should have a faster revolution than the vanes, *d*, as above described.

Having now described the nature of my invention and the manner of using the same, I would have it understood that what I claim as my invention is the combining the action of the vanes, *d*, with the fan-wheel, *k*, whereby the wind in giving motion to the vanes, *d*, cause the fan-wheel, *k*, to create an exhaustion below it, and a consequent draft up the chimney, and thus prevent or cure what are termed smoky chimneys.—In witness whereof, &c.

Enrolled, October 4, 1834.

[From the American Journal of the Arts and Sciences.]

PORCELAIN AND EARTHENWARE.

The most ancient specimens of this art, are the bricks found in the ruins of Babylon. That city, built by Nimrod, 2,200 years B. C. is now a series of mounds, overspread by the dust of its own decomposition, and lying in huge masses of undistinguishable ruin. Long narrow rifts and channels between the hills, indicate the ranges of its once populous streets; and the great Tower of Babel, the witness and the cause of the confusion of languages, stands highest among the hills—a monument and a record of the advances made in some of the arts, as well as of the ambition of the inhabitants in that early age of the world. The city is given over to desolation—the Euphrates annually overflows all but its highest summits; but when the waters retire, the mounds are perforated in every direction for building materials, and in the hope of finding hidden treasures. Mr. Rich, a late traveller describes the Birs Nemrood, the largest of the mounds, as seven hundred and sixty-two yards in circumference, and one hundred and ninety-eight feet high. It is supposed to be the Tower of Babel, and consists of three receding stories. The interior of the mass is filled up with unburnt bricks, set in

clay, with layers of reeds between every five or six courses. The exterior, wherever it remains entire, is faced with well burnt bricks set in bitumen. From the present appearance of the mound, it is conjectured that it was intended to consist of five stories—the three lower solid, and the two above to have contained chambers. At the top of this pile, there is another solid elevation, thirty-seven feet high, of burnt bricks set in lime mortar. Many of the heaps and hills are connected by galleries and passages of brick work, laid in lime mortar of exceeding toughness. In some of the excavations have been found earthen vessels, which are presumed to be the most ancient specimens wrought by the potter's wheel.

Bricks were also made by the Egyptians, and Herodotus states, that one of the pyramids was built of unburnt bricks made of clay and chopped straw, probably like those required by the task masters of the children of Israel, when they were subject to Egyptian bondage. Mr. Aiken remarks, that sunburnt bricks were rather artificial stone than earthenware; and Pliny mentions that at Utica no bricks were allowed to be used until they had been dried five years. Many buildings of high antiquity were formed of brick—such were the palace of Crœsus king of Lydia, of Mausolus of Halicarnassus, and of Attalus at Tralles. The walls of Athens, which look towards mount Hymettus are also of brick, and some of the ancient temples of that city.

The Romans were skilful in their methods of making and burning bricks, and in all the remains of Roman walls, forts and buildings in Great Britain, they are of an excellent quality, of a deep red color, very hard and well burnt. Throughout the wide valley of the Ganges, bricks appear to have been used from the highest antiquity; and in Nipaul, a hilly country north of Bengal, they are of such remarkably compact texture, and their ornamented surfaces so elegant, as to be peculiarly fitted for the decorations of architecture. In China, bricks are made of a blueish clay, and after burning are of a semi-porcelainous texture.

After the Romans left England, bricks were not used for architectural purposes before the middle of the 14th century; and until lately they have been fabricated in a very rude manner. They are now made of various kinds, and of superior quality in England, not only for home consumption, but largely for exportation.

It could not have been long after the discovery of the plastic quality of clay, and that by drying or burning it became impervious to water, before the wants and ingenuity of man suggested the application of it to vessels for domestic and culinary uses. Earthenware being peculiarly adapted to keeping water pellucid and cold, jars and vases for holding it soon became articles of first necessity, where it was not plentiful, as in Syria, and many of the middle and eastern parts of Asia. Allusions to earthen vessels—to the potter's clay and the potter's wheel, occur in the most ancient writers. The plastic properties and consequent uses of clay are noticed in the book of Job, the most ancient book now extant; and the potter's wheel is referred to by Homer in his description of Achilles' shield. Earthen vessels were in use among the Hebrews when they received the law from Moses; and the prophets often refer to the power of the potter over that most ductile material, the clay, as illustrating the relative position of man, in the hands of him who moulds our purposes at his will.

The arts flourished soon after the deluge, to a surprising extent, in Sidon, the capital of Phœnicia, a narrow country, between mount Lebanon and the most eastern coast of the Mediterranean Sea. This city was nearly coeval with Babylon, being founded soon after the confusion of languages, more than 2,000 years before Christ. It excelled in manufactures of fine linen, embroidery, tapestry, metals and glass; of the latter there were many varieties, such as colored, figured, turned by the lathe, painted, cut or carved, and even mirrors; but no mention is made, at this date, of porcelain, unless the article named as painted glass was a species of that manufacture. To this people is ascribed the invention of boats—of navigation—of the application of astronomy to nautical purposes—of book-keeping—of writing—of arithmetic and of weights and measures. They sent colonies to Greece and Italy, and with their little boats of wicker work, covered with leather, they coasted the Mediterranean, and made various settlements in the south and west of Europe, and on the northern shores of Africa. At a very early period, a colony of Phœnicians settled on the west coast of Italy, and carried the perfection of their arts and manufactures

to Etruria; but Pliny ascribes the introduction of those beautiful earthen vases into Etruria, of which admired specimens have come down to our own times, to two artists from the isle of Samos. The Samians were famous 500 or 600 years before Christ, for their manufactures of gold and silver, and for a fine earthenware resembling the modern porcelain, which Herodotus states was in great demand at Rome, for the service of the table.

Although the coarser kinds of earthenware were invented in the earliest periods, yet there are no records of a manufacture so elegant and complicated as porcelain, until near the Christian era; unless the Samian vases claim that distinction.*

The celebrated Murrhine cups or vases, which were introduced into Rome 14 years B. C. have divided the opinions of antiquaries. Propertius speaks of them as baked in Parthian furnaces. Martial alludes to them as filled with heated wine. Pliny thought them made of a fossil substance, and says "they were first brought by Pompey to Rome, in his great triumph over Asia and Pontus. Murrha comes from Parthia and Caramania, and unwrought specimens, together with the cups, were dedicated to Jupiter Capitolinus, and placed in his temple. They were not translucent, but peculiarly splendid, from the great variety of hues reflected from them in spots and waves—changing from white to purple —sometimes edged with a tint of flame color, and interspersed with variable iridescent rays." If they were not a variety of oriental porcelain, they were probably made of the *adularia*,† which is found in Arabia, Persia, and Ceylon. They were in such esteem at Rome, in the first ages of the Christian era, that two of them were bought by one of the emperors at the price of 300 sestertium, more than £2,000 sterling each. A cup, capable of holding three sextarii, ($4\frac{1}{2}$ pints) was sold for seventy talents, and a dish for three hundred: a talent being equal to £180 English. The author of the Periplus of the Erythrean Sea, says they were made at Diospolis, in Egypt.

In the time of Herodotus, vessels of earthenware were very scarce and highly esteemed by the nations around. "Twice in every year," says he, "there is exported from different parts of Greece to Egypt, and from Phœnicia in particular, wine secured in earthen jars, not one of which jars is ever after seen; for the principal magistrates collect all that are imported and send them to Memphis. The Memphians fill them with water, and afterwards transport them to the Syrian deserts." From Juvenal, who wrote in the first century of the Christian era, 500 years after Herodotus, it appears that earthenware was then made in great plenty in Egypt. Images covered with a deep blue glaze have been found enclosed with mummies, in a number of sarcophagi, which is conclusive evidence, that the art had advanced to a very considerable degree of excellence, nearly 2,000 years ago, the blue being found, on examination, to be a preparation of cobalt, the identical material employed by the potters of the present day. Gov. Pownall describes certain vases and urns discovered on the Mexican coast, "as curious exemplars of some of the first efforts of human ingenuity;" and adds, "that remains of ancient potteries are visible in various parts of South America, particularly on the river Amazon." Mr. Parkes states, that "urns of earthenware have been found in the barrows of England, supposed to have been the workmanship of the ancient Britons," and some have been imagined, from their peculiar form, to have been designed for Druidical rites. Pieces of a rude ware, of Roman manufacture, have been drawn up by fishermen, in the mouth of the Thames, where, 2,000 years ago, there was an island, which has disappeared with the changing sands of that coast. They were evidently designed for use in the religious ceremonies of the Romans.

Vessels of earthenware have been discovered in the tumuli of the valley of the Ohio and its tributaries. Those for domestic use were found deep in the mound, where duty and affection had placed them for the comfort of the endeared relation or friend; while others with emblematical designs, probably connected with idolatrous worship, hallowed the grave of the unknown race with whom they were enclosed; and every sepulchre of a hero is made the temple of a god.

The mystery and concealment observed by the Chinese, in regard to their manufac-

* The term porcelain is of European origin. Whittaker derives it from the herb purslain: the most ancient china brought to Europe, being the exact color of its purple flower. Mr. Aikon thinks it an Italian word, signifying an arched univalve shell, remarkable for its white, smooth texture, and vitreous gloss.

† In its finest specimens, sometimes used as a gem.

tures, kept this art from the rest of the world long after they had arrived at a great degree of perfection. Specimens of Chinaware and the lacquer called japannery, were found both in China and the Japan islands, of excellent quality, by the earliest European travellers; and in addition to vessels of the most delicate and beautiful texture, which appeared to have been in use from time immemorial, they make mention of temples incrusted with tiles of various colors and curious workmanship; but it was not until the conquest of China by Genghis Khan, in 1212, that the art of glazing earthenware was made known to the rest of Asia. The empire of Genghis extended from China across the whole pastoral region of Asia, to the Caucasus, and in their progress they held both hostile and friendly intercourse with the Saracens. That splendid race were at this time not only warlike, but inquisitive, active and ingenious; and it appears probable that this art was transported by them from the confines of China to Spain and northern Africa. Many rooms in the Moorish palace of the Alhambra, are decorated with lacquered tiles, and the cupola and minarets on the tomb of the Sultan Mahomed, at Sultanyah, in Persia, built at the same period, are covered with green lacquered tile, the great architrave being formed of blue of corresponding quality.

In 1270, Marco Polo, a Venetian, visited the court, and was for several years in the service of Kublai Khan, the grandson of Genghis; during which time the merchants of Italy were travelling for commercial purposes in most countries between Syria and India. Earthenware, covered with a vitreous glaze, was imported by them from the east, and Florence became a celebrated mart for this ware, which met a ready sale throughout Europe. The maritime laws of Barcelona, which bear date 1096, mention porcelain among imports from Egypt; but it was far from being common, or even generally known in Europe, in the 14th century. The Sultan of Egypt sent large vases of porcelain to Lorenzo de Medici, in 1487, of Egyptian manufacture, and they are said to have derived their skill from the Corinthians, who had obtained the art from the east. The Persians also arrived at great perfection in the potter's art at a period of remote antiquity; and it is worthy of remark, that porcelain is not made in the Indies, but that all the countries of Asia have been supplied from China, Pegu, Japan and Persia.

Porcelain was not common in Europe before the first ages of the Christian era. Rome was supplied from Samos. Vases and utensils of oriental or Egyptian manufacture have been disinterred from Herculaneum and Pompeii; also, wine jars and drinking cups of terra cotta, which is a fine redish, unglazed ware. Statues of the gods were made in Rome, of terra cotta, until the introduction of marble statues from Greece, by Lucullus and Pompey.

[From the Repertory of Patent Inventions.]

Progress of Science applied to the Arts and Manufactures, to Commerce, and to Agriculture.

Negative Achromatic Lens.—In the preceding volume, p. 383, we gave a notice of the invention of this improvement in telescopes: the following is an abstract of another paper on the subject, read before the Royal Society on the 29th of May last, entitled "On the Principle of Construction and General Application of the Negative Achromatic Lens to Telescopes and Eyepieces of every description. By Peter Barlow, Esq., F.R.S."

This paper is intended as a more full illustration of the principles on which the negative achromatic lens is constructed and applied, than has been given in the extract from the author's letter to Mr. Dollond, contained in the paper of the latter, lately read to the society, on his ingenious application of that lens to the micrometer eyepiece. The author shows that its advantages are not confined to this instrument, but that it is applicable to any eyepiece positive or negative to the erecting eyepiece, and, indeed, to any telescope of fluid or glass, and also to refractors.—*Proceedings of the Royal Society.*

On Naval Architecture. By Jeremiah Owen.—A great deal has been done by mathematicians towards attempting to establish a general theory of resistances, and considerable expense has been incurred in conducting experiments, some of which have been made on the continent under the superintendence of eminently scientific men. D'Alembert, Bossut, Romme, and several others, were employed at different times in experiments of this nature. Don Juan in

Spain, and Chapman, the great Swedish naval architect, also made several experiments on the same subject; as did also the Society for the Improvement of Naval Architecture, which was established in England some years ago, but which has now ceased to exist.

These experiments have always been made upon models, the largest of which, it is believed, have never exceeded 14 feet in length. They were generally much smaller. The results which have been thus obtained on small bodies have not been found to agree with results similarly obtained on larger bodies, and not only has this been the case, but experiments conducted apparently with equal care by different individuals, have even led to different results.

Naval architecture has, consequently, gained but little from the labor that has been bestowed upon these experiments, and the forms which have been given by different individuals to ships, have depended rather upon the fancy and general experience of those individuals, than upon any facts which this branch of experimental science has furnished.

In order to discover that form of the body of a ship which shall oppose the least resistance to its passage through the water, the author recommends that experiments be made on ships themselves, under all the ordinary circumstances of sailing.

These experiments must be conducted not in the mode in which experimental squadrons have hitherto been, viz. by comparing together the sailing qualities of ships that have varied in every particular. We are no more justified in saying that results obtained in this way have proved which form of body is best calculated for velocity, than we are in saying which ship has been the best managed.

If it be desirable to discover by experiment which of two or more forms is best adapted for velocity, it is, of course, necessary that the form shall be the only variable element; the ships in *every other* respect must be exactly similar.

By the aid which mathematics afford, we shall be able most completely to accomplish this. Let a ship be given which sails well, and which is in all other respects an efficient man-of-war, as regards capacity, stability, &c. &c. Let this ship be docked, and let the most complete drawings of her form be made, from which we shall be able to calculate exactly every necessary element, such as displacement, area of midship section, of loadwater section, stability, &c., and let the surface of sail, the position and rake of masts, be also ascertained.

Then let one or more ships be constructed, having exactly the same principal elements as the given one, with whatever difference of form it may be thought proper to select, and let the same surface of sail be given to them all. We shall thus have the same weights to be moved, and the same propelling force to move them; the result will, of course, show which form is best calculated for velocity.

These ships may be made to sail against each other under every possible circumstance of sailing, taking care always to apply the propelling force in the same way, that is, by bracing the corresponding yards of all the ships to the same angle with a fore and aft line, during every comparison, and by raking the masts to the same degree.

It is of importance that during the experiments the surface of sail in each ship should be presented, as nearly as possible, at the same angle to the action of the wind, and this is perfectly practicable, for it is easy to measure the angles of the yards by an instrument for that purpose; and the officer who commands the squadron can take care, by means of frequent signals, to have the yards of all the ships braced to the same angle at the same time.

These experiments would not be limited in their result to the discovery merely of that form of a ship which is best calculated for velocity, although this of itself is so important as to justify almost any expense; but we might also be able to discover how far the angle of leeway is affected by the form, which is also a very important question connected with the sailing of ships; and after having, by repeated and careful trials, discovered the order of superiority of ships in respect to velocity, we might then, by varying the angle of bracing the yards, discover also the trim of the sails and the course of the ship by which to gain most on a wind, a question which is not by any means satisfactorily settled, inasmuch as it involves all the uncertainty of our present knowledge of the resistance of fluid.

Experiments to determine this latter question might, however, be made immediately on sister ships, of which there are several at present in his Majesty's service.

Let two ships be selected of the same form, and let the utmost pains be taken to make the position and rake of the masts, the seat in the water, the stowage of the ballast, and of all the heavy weights, exactly the same in both ships, and let them be compared together in sailing both on the wind and at various points off the wind; the angles of bracing the yards being constantly varied, we should doubtless, from a series of experiments of this nature, succeed in discovering the best trim of the sails for every direction of the wind on every course.

It may, perhaps, be urged against a series of experiments like those which have been here recommended, that the expense of building a ship is so great as to render it advisable not to run the risk of building a bad one for the sake of experiment merely. But the author suggests that our knowledge of naval architecture is such as to enable us to construct ships which we can certainly predict will be good, notwithstanding they may not be the best that might be produced; and the ships which would be included in the experiments proposed would have all the essential qualities of a man-of-war, except that by differing in form, some would be superior to others in respect to velocity.

Naval architecture is a branch of science which depends so essentially upon experiment for its advancement, and the experiments are necessarily upon so large and expensive a scale, as to place it out of the power of individuals, or even of societies of individuals, to conduct them. It is, therefore, one of those enterprises in science which none but a nation can undertake; and it is worthy of so great a maritime nation as England to endeavor to advance, at whatever reasonable cost, a subject so important in its defence.—*Report of the Third Meeting of the British Association for the Advancement of Science.*

On a Steam-Engine for pumping Water. By W. L. Wharton.—In this engine the steam is admitted from the boiler upon a deep float, occupying the top of a column of water contained in a metallic cylinder, placed in the flue of the boiler fire. The lower part of the column of water is connected by pipes to the under side of a piston, moving water-tight in a much smaller cylinder, fixed immediately above the pumps of any mine, to the rods of which is affixed the piston rod. By this arrangement the steam always acts upon a heated surface, and its power is applied to the pump rods without the intervention of a main beam, parallel motion, &c., and consequently, without any expense for frame-work and buildings requisite for their support in other engines. The friction of this engine, moreover, is very trifling, a stratum of oil being introduced both above and below the piston. A rod or wire is attached to the float, and, passing through a stuffing-box in the top of the large cylinder, works the hand-gear at the proper periods after the admission and escape of the steam, and consequent depression and elevation of the water and float, within that cylinder. A condensing apparatus may be added, by which the atmosphere may be rendered available, in addition to the weight of the pump rods, to force down the piston in the small cylinder, and, consequently, the water and float to the top of the large cylinder, after each stroke of the engine.—*Report of the Third Meeting of the British Association for the Advancement of Science.*

Laws of Motion of Steam-Vessels.—The following is the official abstract of a paper read before the Royal Society, on the 29th of May last, entitled "An Investigation of the Laws which govern the Motion of Steam-Vessels, deduced from experiment. By P. W. Barlow, Esq., Civil Engineer."

The author commences with the description of a paddle-wheel for steam-vessels, of a new construction, in which the floats are made to enter and leave the water nearly in a vertical position. He then investigates several formulæ adapted to the calculation of the forces and velocities arising from this form of the apparatus; and gives an account of the results of various experiments made on its efficiency as compared with the common wheels, and with relation to the consumption of fuel. The general results to which he is led are as follows: 1st. When vessels are so laden as that the wheel is but slightly immersed, little advantage is derived from the vertically acting paddles. 2ndly. In cases of deep immersion, the latter has considerable advantage over the wheel of the usual construction. 3rdly. In the common wheel,

while the paddle passes through the lower portion of the arc, that is, when its position is vertical, it not only affords less resistance to the engine, but is less effective in propelling the vessel than in any part of its revolution. 4thly. The paddle of the wheel, while passing through the lower portion of the arc, affords more resistance to the engine, and is more effective in propelling the vessel, than in any part of its revolution; a property which is a serious deduction from its value; for, in consequence of the total resistance to all the paddles being so much less than in the common wheel, much greater velocity is required to obtain the requisite pressure, and a greater expenditure of steam power is incurred. This loss of power is most sensible when the wheel is slightly immersed; but in cases of deep immersion, the vertical paddle has greatly the advantage. 5thly. In any wheel, the larger the paddles the less is the loss of force; because the velocity of the wheel is not required to exceed that of the vessel in so great a degree, in order to acquire the resistance necessary to propel the vessel. 6thly. With the same boat and the same wheel no advantage is gained by reducing the paddle so as to bring out the full power of the engine; the effect produced being simply that of increasing the speed of the wheel, and not that of the vessel. 7thly. An increase of speed will be obtained by reducing the diameter of the wheel, at least within such limits as allow of the floats remaining sufficiently immersed in the water; and provided the velocity of the engine does not exceed that at which it can perform its work properly. 8thly. An advantage would be gained by giving to the wheel a larger diameter, as far as the immersion of the paddles produced by loading the vessel would not so sensibly affect the angle of inclination of the paddle; but this advantage cannot be obtained with an engine of the same length of stroke, because in order to allow the engine to make its full number of strokes, it will then be necessary to diminish the size of the paddles, which is a much greater evil than having a wheel of smaller diameter with larger paddles.—*Proceedings of the Royal Society.*

ON THE THERMOSTAT, OR HEAT-GOVERNOR, A SELF-ACTING PHYSICAL APPARATUS FOR REGULATING TEMPERATURE. BY ANDREW URE, M.D., F.R.S., &c.—This instrument acts by the unequal expansion of different metals in combination; it admits of many modifications of external form, but in all, the metallic bars must possess such force of flexure in heating or cooling as to enable their working rods or levers to open or shut valves, stopcocks, and ventilating orifices.

Steel and zinc are the two metals employed: they possess a great difference of expansiveness, nearly as two to five, and are sufficiently cheap to enter into the composition of thermostatic apparatus; but zinc has in reference to the present object one property which should be corrected. After being many times heated and cooled, a rod of that metal remains permanently elongated. This property may, however, be in a great measure destroyed, and considerable rigidity acquired by allying it with four or five per cent. of copper and one of tin. Such an alloy is hard, close-grained, elastic, and very expansible, and therefore suits pretty well for making the more expansible bar of a thermostat.

Let a bar of zinc or of this alloy be cast, about an inch in breadth, one-quarter of an inch thick, and two feet long, and let it be firmly and closely riveted along its face to the face of a similar bar of steel of about one-third the thickness. The product of the rigidity and strength of each bar should be nearly the same, so that the texture of each may pretty equally resist the strains of flexure. Having provided a dozen such compound bars, let them be united in pairs by a hinge-joint at each of their ends, having the steel bars inward. At ordinary temperatures the steel plates of such a pair of compound bars will be parallel and nearly in contact, but when heated they will bend outwards, receding from each other at their middle parts, like two bows tied together at their ends. Supposing this recession to be one inch for 180° Fahrenheit, then six such pairs of bows, connected together in an open frame with rabbeted end plates, and with a guide-rod playing through a hole in the centre of each, will produce an effective aggregate motion of six inches, being half an inch for every 15° Fahr., or $8\frac{1}{3}$° C. Instead of limiting ourselves to half a dozen such pairs of compound bars, we may readily lodge in a slender iron frame a score or two of them, so as to furnish as great a range of motion as can be desired for most purposes of heat regulation; and the power

of pressure or impulsion may be increased, if necessary, by increasing somewhat the thickness of each component lamina. One extremity of the series must obviously be firmly abutted against a solid fulcrum or bearing, while the opposite extremity gives motion to a working-rod of a suitable kind.

The author of the communication then describes in detail the various mechanical adjustments by which the apparatus may be applied to maintain any determined rate of ventilation through the casements of church windows; to give alarm and open valves in water-cisterns in case of fire; to preserve a certain rate of combustion in furnaces, a uniform temperature in baths and stills, and to act as a safety-valve for a steam-engine.—*Report of the Third Meeting of the British Association for the Advancement of Science.*

On Chinese Vermilion.—[Translated into French from a Chinese Technologic Encyclopædia, entitled, *Thian-koung Kai-we*, or *Exposition of the Wonders of Nature and the Arts.* By M. Stanislas Julien.*] From the *Nouveau Journal Asiatique.*

Cinnabar, liquid silver, the red of silver, are, in reality, one and the same thing. What causes them to bear different names, is, that the substance is either pure or coarse, or old or recently extracted.

Cinnabar, of the first quality, comes from *Chinpe* (now *Mayang*,) and from *Sitchouan*.

It is found in a state of purity in the bosom of the earth, and does not require purification by fire. This cinnabar, which is used to polish the tips of arrows, metallic mirrors, &c., is thrice as valuable as mercury; whence it is carefully picked and sold under its native form, that is, in the state of sand or red powder. If melted it loses a great part of its value.

The coarse cinnabar, of the second quality, needs to be purified by the fire, when it forms mercury.

The cinnabar of the first quality is found by digging the ground at a depth of seventy feet. The presence of the mineral is indicated by the appearance of small white granular stones. The largest pieces are of the size of an egg. The second sort does not enter into any pharmaceutic preparation. It is ground up and used by the painters and colorists in the same manner as that which is prepared directly from mercury. Its matrix does not always appear under the form of white stones, but has sometimes a mixture of blue and yellow. It is found about twenty feet below the other. Sometimes it is met with in a stratified sandy soil, and then the stony and sandy gangue is easily separated. This kind of cinnabar is found in abundance at *Koucitchou Ssein*, at *Thoungjin*, &c., also in great quantities at *Changtcheou*, and at *Tsintcheou*.

The cavities from which the second sort is collected, have a whitish aspect. When recently extracted, it may be separated without the necessity of previous founding. This cinnabar, on first coming from the mine, has a brilliant surface, which soon tarnishes on contact with the air.

To prepare the vermilion, they take the cinnabar, and pound it in an iron mortar, shaped like a boat, with a stone pestle of a flattened spherical form, and placed at the end of a vertical lever moved by four men, by means of a bar which passes through it. The powder is thrown into clear water, and left to soak for three days and three nights. One part falls to the bottom of the vessel, the other, lighter, floats on the surface: this is removed with a skimming ladle, and placed in a second vessel. It is then called *Eult chou*, or *second red.* The cinnabar which was deposited in the first vessel is taken out, dried in the sun, and is then called *Theout chou*, or *first red.*

To obtain quicksilver from the ores, either the second quality, inferior cinnabar, white and newly extracted, or the deposite or the scum separated on the surface of the water, are employed. Thirty pounds of one of the above ores are put into an iron vessel, with a convex head of the same metal, having a small opening in its centre; the two are carefully luted together, and a curved iron tube fitted hermetically into the aperture at the top, with hemp and luting.

Thirty pounds of charcoal are necessary for the distillation: when the retort becomes hot, one end of the iron tube is plunged into cold water, so that the vapor which rises from the metal-pot distils over through the tube, and condenses in the water. In five hours the whole of the cinnabar is transformed into mercury, which is taken out of the water after having been suffered to repose for twenty-four hours.

Sometimes the mercury is treated afresh,

* The Chinese edition, whence this article is extracted, bears the date of 1637.

to be converted into vermilion, which is then called *Intchou*, that is to say, *red of quicksilver*. A retort of porcelain, or a double vessel of metal, are employed indifferently for this purpose: to one pound of mercury, two pounds of sulphur are added; the mixture is triturated until it forms a blackish powder: it is then put into the crucible, which is covered with an iron cover, held down by a bar of iron laid across the top of it, and tied down on either side to the lower vessel, by means of a loop of brass wire made fast round the latter. All the openings are then carefully closed with lute, and the pot is set upon an iron tripod, under which a fire of resinous fagots is maintained for a considerable time; whilst the cover is kept cool with an old swab soaked in water. The mercury then combines with the sulphur, and sublimes in a very fine powder, which adheres to the sides of the vessel. The cinnabar which fixes on the inside of the cover is of the brightest color. When the vessel is quite cold, the vermilion is taken out. The excess of sulphur is found precipitated to the bottom, and may be employed a second time. One pound of mercury gives fourteen ounces of cinnabar of the first quality, and three ounces and a half of the second quality.

The cinnabar obtained by the action of fire, and that from the pulverized native ore, have exactly the same appearance; nevertheless, the former is never used in painting the houses of princes and persons of distinction: the only sort employed for this purpose being the pure pulverized mineral from *Thoung chin* and *Pe-tchouan*.

When intended to be used in writing, the vermilion is ground up with gum, and made into small cakes. Rubbed upon a stone pallet, (encrier,) it presents a red of the richest brilliancy: if pounded on a tin slab, it forms a black color, and is then fit for the varnishers, and gives to objects a glistening tint which enhances their price. Mixed with the oil of the *Thoung tree*, it assumes a very bright appearance: but if varnish be added to this, it loses its brilliancy and becomes of a deep black color.

Thus we have faithfully described all that concerns the preparation of native and artificial cinnabar, as well as that of mercury. All that has been said about *the sea of cinnabar*, and *the vegetable cinnabar*, rests on no foundation whatever: they are mere reveries fit to amuse the credulous and lovers of the marvellous.

When mercury has been converted into vermilion, it has no longer the power to return to its original state, because it has then arrived at what may be called *the final limit of transformation*.—*Journal of the Asiatic Society of Bengal, for April*, 1832.

On the Native Method of Making the Paper, denominated in Hindustan, Nipalese. By B. H. Hodgson, Esq., Acting Resident, Nepal.—For the manufacture of the Nipalese paper, the following implements are necessary, but a very rude construction of them suffices for the end in view.

1st. A stone mortar, of shallow and wide cavity, or a large block of stone, slightly but smoothly excavated.

2d. A mallet or pestle of hard wood, such as oak, and in size proportioned to the mortar, and to the quantity of boiled rind of the paper-plant which it is desired to pound into pulp.

3d. A basket of close wicker work, to put the ashes in, and through which water will pass only drop by drop.

4th. An earthen vessel or receiver, to receive the juice of the ashes after they have been watered.

5th. A metallic open-mouthed pot, to boil the rind of the plant in. It may be of iron, or copper, or brass, indifferently; an earthen one would hardly bear the requisite degree of fire.

6th. A sieve, the reticulation of the bottom of which is wide and open, so as to let all the pulp pass through it, save only the lumpy parts of it.

7th. A frame, with stout wooden sides, so that it will float well in water, and with a bottom of cloth, only so porous that the meshes of it will stay all the pulp, even when dilated and diffused in water: but will let the water pass off, when the frame is raised out of the cistern; the operator must also have the command of a cistern of clear water, plenty of fire-wood, ashes of oak, (though I fancy other ashes might answer as well,) a fire-place, however rude, and, lastly, quantum sufficit of slips of the inner bark of the paper-tree, such as is peeled off the plant by the paper-makers, who commonly use the peelings when *fresh* from the plant; but that is not indispensable. With these "appliances and means to boot," sup-

pose you take four seers of ashes of oak, put them into the basket above mentioned, place the earthen receiver or vessel beneath the basket, and then gradually pour five seers of clear water upon the ashes, and let the water drip slowly through the ashes and fall into the receiver. This juice of ashes must be strong, of a dark bark-like red color, and in quantity about 2lbs.; and if the first filtering yield not such a produce, pass the juice through the ashes a second time. Next, pour this extract of ashes into the metal-pot already described, and boil the extract, and as soon as it begins to boil, throw into it as many slips or peelings of the inner bark of the paper-plant as you can easily grasp, each slip being about a cubit long, and an inch wide; (in fact the quantity of the slips of bark should be to the quantity of juice of ashes, such that the former shall float freely in the latter, and that the juice shall not be absorbed and evaporated with less than half an hour's boiling.) Boil the slips for about half an hour, at the expiration of which time, the juice will be nearly absorbed, and the slips quite soft. Then take the softened slips, and put them into the stone mortar, and beat them with the oaken mallet, till they are reduced to a homogeneous or uniform pulp, like so much dough. Take this pulp, put it into any wide-mouthed vessel, add a little pure water to it, and churn it with a wooden instrument like a chocolate-mill, for ten minutes, or until it loses all stringiness, and will spread itself out when shaken about under water.

Next, take as much of this prepared pulp as will cover your paper-frame, (with a thicker or thinner coat, according to the strength of the paper you need,) toss it into such a sieve as I have described, and lay the sieve upon the paper-frame, and let both sieve and frame float in the cistern; agitate them, and the pulp will spread itself over the sieve; the grosser and knotty parts of the pulp will remain in the sieve, but all the rest of it will ooze through into the frame. Then put away the sieve, and taking the frame in your left hand, as it floats on the water, shake the water and pulp smartly with your right hand, and the pulp will readily diffuse itself in a uniform manner over the bottom of the frame. When it is thus properly diffused, raise the frame out of the water, easing off the water in such a manner that the uniformity of the pulp spread shall continue after the frame is clear of the water, *and the paper is made.*

To dry it, the frame is set endwise, near a large fire; and as soon as it is dry, the sheet is peeled off the bottom of the frame, and folded up. When (which is seldom the case) it is deemed needful to smooth and polish the surface of the paper, the dry sheets are laid on wooden boards, and rubbed with the convex entire side of the conch-shell; or, in case of the sheets of paper being large, with the flat surface of a large rubber of hard smooth-grained wood; no sort of size is ever needed or applied to prevent the ink from running. It would probably surprise the paper-makers of England, to hear that the *Kachar* Bhoteahs can make up this paper into fine smooth sheets of *several yards square.* This paper may be purchased at Katmandu in almost any quantity, at the price of seventeen annas sicca per *dharni* of three seers: and the bricks of dried pulp may be had* at the same place, for from eight to ten annas sicca per *dharni.* Though called Nipalese, the paper is not, in fact, made in Nepal Proper. It is manufactured exclusively in Cis-Himalayan Bhote, and by the race of Bhoteahs denominated (in their own tongue) *Rangbo,* in contradistinction to the Trans-Himalayan Bhoteahs, whose vernacular name is *Sokhpo.*† The *Rangbo* or Cis-Himalayan Bhoteahs are divided into several tribes, (such as *Murmi, Lapcha,* &c. &c.,) who do not generally intermarry, and who speak dialects of the Bhote or Tibet language so diverse, that, ignorant as they are, several of them cannot effectually communicate together. They are all somewhat ruder, darker, and smaller, than the Sokhpos, or Trans-Himalayan Bhoteahs, by whom they are all alike held in slight esteem, though most evidently *essentially* one and the same with themselves in race, and in language, as well as in religion.

To return to our paper-making—most of the Cis-Himalayan Bhoteahs east of the Kali River, make the Nipalese paper; but the greatest part of it is manufactured in

* The pulp is dried and made up into the shape of bricks or tiles, for the convenience of transportation. In this form, it is admirably adapted for transmission to England. See the P. S.

† The Newar language has terms precisely equivalent to these; the Rangbo being called, in Newary, Paloo Sen; and the Sokhpo, Tha Sen. The Sokhpo here spoken of is not really a different word from Soghpur-nomade, the name *ordinarily* applied in Bhote to the Mongols. But this word has at least a different sense in the mouths of the Tibetans towards *this* frontier, on both sides of the snows.

the tract above Nepal Proper, and the best market for it is afforded by the Nipalese people, and hence probably it derived its name; a great quantity is annually made and exported southwards to Nepal and Hindustan, and, northwards to *Sakya-Gumba*, *Digarchi*, and other places in Tramontane Bhote. The manufactories are mere sheds, established in the midst of the immense forest of Cis-Himalayan Bhote, which affords to the paper-makers an inexhaustible supply, on the very spot, of the firewood and ashes, which they consume so largely. Abundance of clear water (another requisite) is likewise procurable everywhere in the same region. I cannot learn by whom or when the valuable properties of the paper-plant were discovered; but the Nipalese say, that any of their books now existent, which are made of Palmira leaves, may be safely pronounced, on that account, to be five hundred years old; whence we may perhaps infer that the paper manufacture was founded about that time. I conjecture, that the art of paper-making was got by the Cis-Himalayan Bhoteahs, via Lhassa, from China—a paper of the very same sort being manufactured at Lhassa; and most of the useful arts of these regions having flowed upon them, through Tibet, from China; and not from Hindustan.

Nepal Residency, Nov., 1831.

P. S. Dr. Wallich having fully described the paper-*plant*, it would be superfluous to say a word about it. The raw produce or pulp (beat up into bricks) has been sent to England, and declared by the ablest persons, to be of unrivalled excellence, as a material for the manufacture of that sort of paper upon which proof-engravings are taken off. The *manufactured* produce of *Nepal* is for office records incomparably better than any Indian paper, being as strong and durable as leather, almost, and quite smooth enough to write on. It has been adopted in one or two offices in the plains, and ought to be generally substituted for the flimsy friable material to which we commit all our records.—*Jour. of the Asiat. Soc. of Bengal, Jan.* 1832.

ACCOUNT OF THE DEPTHS OF MINES. BY JOHN TAYLOR, F.R.S.—Mr. Taylor exhibited a section, showing the depths of shafts of the deepest mines in the world, and their position in relation to the level of the sea.

The absolute depths of the principal ones were:

		feet.
1.	The shaft called Roehrobichel, at the Kitspuhl mine in the Tyrol	2764
2.	At the Sampson mine, at Andreasberg in the Harz	2230
3.	At the Valenciana mine, at Guanaxuato, Mexico	1770
4.	Pearce's shaft, at the Consolidated mines, Cornwall	1464
5.	At Wheal Abraham mine, Cornwall	1452
6.	At Dolcoath mine, Cornwall	1410
6.	At Ecton mine, Staffordshire	1380
8.	Wolf's shaft, at the Consolidated mines	1350

These mines are, however, very differently situated with regard to their distances from the centre of the earth, as the last on the list, Wolf's shaft, at the Consolidated mines, has 1230 feet of its depth below the surface of the sea, while the bottom of the shaft of Valenciana, in Mexico, is nearly 6000 feet in absolute height above the tops of the shafts in Cornwall. The bottom of the shaft at the Sampson mine in the Harz is but a few fathoms under the level of the ocean; and this and the deep mine of Ritspuhl form, therefore, intermediate links between those of Mexico and Cornwall.

Mr. Taylor stated, that taking the diameter of the earth at 8000 miles, and the greatest depth under the surface of the sea being 1230 feet, or about $\frac{1}{4}$ of a mile, it follows that we have only penetrated to the extent of $\frac{1}{32000}$ part of the earth's diameter.

Some account was then given of the mines to which the shafts referred to belong.

Of the deepest, at Kitspuhl, as it has long ceased to work, we do not know much. Villefosse, in his great work on the *Richesse Minerale de l'Europe*, states that this was a copper mine, which passed for being the deepest in Europe; and that in 1759, it was reported on, amongst other mines, by M. M. Jars, and Duhamel, and it was then proposed to abandon the working, the water having been already suffered to rise near 200 fathoms.

The Sampson mine, in the Harz, is one of the most celebrated in that district: it has been working since the middle of the 16th century, and produces silver ores of superior quality. The principal shaft is sunk about six feet deeper every year, by which ground enough is drained for a regular extraction of the ores. The mine is one of the oldest in Germany, and has always been profitable: it employs from 400 to 500 men. It is the property of shareholders, who are very numerous, the inte-

rest having been much subdivided in the course of time.

The mine of Valenciana at Guanaxuato was one of the most renowned in Mexico. It produced annually, about the end of the last century, 360,000 ounces of silver, worth 600,000*l.* sterling, and then employed 3100 persons. The shaft referred to in the section was commenced in 1791, the mine having long been previously worked by other shafts; it had attained its present depth in 1809, when the mine was stopped by the revolution. It is octagonal, and more than 30 feet in diameter, a great part of its depth being walled with beautiful masonry, and is probably the most magnificent work of the kind. The expense of forming this shaft is estimated by Humboldt at the enormous sum of 220,000*l.* The mine was so little troubled with water that it was considered almost a dry one; during the suspension of the works, however, it gradually filled. In 1825, one of the English companies undertook to drain it, which was, after great labor and expense, accomplished; but the mine has not been sufficiently productive since to make it worth while to continue working.

The Consolidated mine forms the most extensive concern in Cornwall, embracing what were formerly several distinct mines, which, as the name indicates, were connected in one undertaking.

This was arranged in 1818, and the mines which had remained unwrought for many years were drained by very powerful steam-engines, and were put into a state of active working. The management was confided to Mr. Taylor and the late Captain William Davey: an outlay of 73,000*l.* was incurred, which has since been repaid, with ample profit. The present produce is 20,000 tons of ore a year, yielding about 1920 tons of fine copper, being one-seventh of the whole quantity raised in Great Britain. The mines employ about 2400 persons, of whom about 1400 are miners, working underground. The water raised to the adit level is about 2000 gallons per minute: the height to which this is lifted is more than 220 fathoms, or 1320 feet; the aggregate weight of the columns of water in the pumps being 512,000 pounds, or about 230 tons, and the whole is put in motion by eight immense steam-engines, four of which are the largest ever made.

The depth of the mines has been increased 100 fathoms since the period of the drainage being completed, being at the rate of about eight fathoms a year.

There are in the whole concern, ninety-five shafts, besides other perpendicular communication from level to level underground, called winzes. The depths of the whole added together make up about 22,000 fathoms, or 25 miles; and the levels, or galleries, will make up, in horizontal distance, a length of 38,000 fathoms, or about 43 miles.

Wheal Abraham is an old copper mine, the working of which was abandoned a few years since, the vein having ceased to be productive in depth. It was, until very lately, the deepest mine from the surface, in Cornwall, but is now surpassed by the Consolidated mines.

Dolcoath mine was formerly called Bullen Garden, and a section of it, as it was at that time, will be found in Dr. Pryce's work, *Mineralogia Cornubiensis*, published in 1778. It was then rather more than 90 fathoms deep, and, probably, one of the deepest mines at that time. It has, therefore, been sunk 140 fathoms since; but, like all the great mines, it has not been in constant work. It has now been actively prosecuted for many years, and, at present, stands third in the list of copper mines in Cornwall, arranging them according to the value of their produce. That of Dolcoath, however, does not amount to one-half of that of the Consolidated mines.

Ecton mine is celebrated in most books on mineralogy as one of the principal copper mines in England; and it was so at one period, though the produce is now inconsiderable. It is situated in Staffordshire, on the borders of Derbyshire, and is very curious, from being in limestone, and having no regular vein. The ore has been found in large masses, irregularly deposited, and is generally taken to be an example of contemporaneous formation. The mine has been regularly worked for a long series of years, and is now nearly exhausted. It is the property of the Duke of Devonshire, and very large profits were given by it in the latter part of the last century, some of which, it is said, were applied by the late Duke to the erection of the beautiful Crescent at Buxton. The mine is not far distant from this place, and is in a very picturesque situation, on the banks of the Manifold.

Mr. Taylor gave some account of the

extent to which steam power is at present employed in Cornwall, in draining the mines which penetrate so far beneath the level of the sea, showing the influence that the great improvements, which have from time to time been made, and many of them even recently, must have upon the production of some of the most useful metals.

The number of steam-engines used in pumping water from the mines in Cornwall in December, 1832, was altogether 64.

Some of these are of immense size and power: there are five in the county, of which the diameter of the cylinder is ninety inches, the pistons making a stroke of ten feet. Four of these are at the Consolidated mines, and the first constructed of this size was planned and erected there by Mr. Woolf. The beam of such an engine weighs twenty-seven tons; the pump-rods are of mast timber, sixteen inches square, connected by iron strapping-plates of enormous weight. The column of water lifted, the rods and beam, make up a weight of more than 100 tons, and this is kept in motion at the rate of from five to ten strokes per minute.

The quantity of coal consumed in drawing water in the same month in all the mines of Cornwall was 84,034 bushels, and the quantity of water delivered, about 19,279 gallons per minute. The weight of water actually poised by all these engines to produce this effect amounts to about 1137 tons.

From calculations carefully made in Mexico as to horse power employed in draining mines, and deduced from a large scale of operations, it is found that the performance is equal to 19,000 lbs. raised one foot high per minute for each horse.

According to this rate, the coal consumed in Cornwall in a month being 84,000 bushels, or 2800 per day, and taking the duty of the engines at 55,000,000 lbs. lifted one foot by each bushel, which is very nearly the fact, it will be found that the sixteenth part of a bushel does as much in raising water in Cornwall as a horse does in Mexico, (working three hours out of twenty-four,) and that thus the number of horses required to drain the mines of Cornwall would be 44,800.—*Report of the Third Meeting of the British Association for the Advancement of Science.* A. T.

[From the Journal of the Franklin Institute.]

MONTHLY CONVERSATION MEETING.—The first conversation meeting of the Institute, for the season, was held at their Hall, Sept. 25th, 1834.

Mr. L. Norcross, of Dixfield, Maine, exhibited his diving apparatus, with which he had made an experiment in presence of a committee of the Institute, at the Navy Yard. The apparatus consists of a water-proof dress, of gum elastic cloth, and a metallic headpiece, with appropriate tubes for the admission of fresh air, and the escape of that vitiated by respiration. The air is forced in by a pump. A glass window in front of the headpiece, enables the operator to examine any object, and his hands are at entire liberty.

Mr. Haydock, of Philadelphia, submitted to the examination of the members, a copper vessel, which had been used as a cistern, and connected with the city water-works, and which, during that connexion, had collapsed. The explanation of this phenomenon is understood to have been given by Professor Hare, to the Philosophical Society of this city.

A mortising machine, by Mr. John H. Chandler, of Worcester, Mass., was put in operation, and attracted much attention.

Professor W R. Johnson exhibited apparatus for determining the latent heat of melting iron, and the specific heat of the same metal in a state of fusion, which had been employed in connexion with his steam byrometer, in recent experiments on those subjects.

Committee on Science and the Arts.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a plan for preventing accidents from the breaking of the axles of Rail-Road Cars and Locomotives, invented by Mr. Joseph S. Kite, of Philadelphia, Report:—

It is well known that the fracture of such axles almost invariably takes place near the nave, or hub of the wheel, and the desideratum in such a case, is to preserve the two pieces of axle from *falling to the ground*, and, consequently, overturning the car.—This, Mr. Kite proposes to effect, by introducing in each car, two longitudinal pieces of timber, (which he calls *safety-beams*,) inside of the wheels, and parallel to the usual string-pieces, which support the boxes or chairs of the axles. To these inside beams

are attached an additional set of chairs, which in order to avoid unnecessary friction, are so arranged as not to come in con tact with the axle, except when the latter breaks.

When this happens, they arrest the descent of the pieces, and thus not only retain the car in an upright position, but may even permit it, in some cases, to proceed as before. These chairs are so constructed with double bearings, as to allow play to two axles of different diameters, the *smaller* bearing being for the axle *proper*, and the *larger* one for the *nave of the wheel*; which, if the break takes place immediately at the union of the hub and axle, becomes itself a *temporary* axle, upon which its attached wheel revolves independently of the axle *proper*—the latter, with *its* wheel, being supported by the *smaller* bearing of the double chair. The wheels are prevented from separating transversely, by means of proper keepers outside of the chairs.

The committee consider Mr. Kite's arrangement both effective and simple, and consequently recommend it as deserving of practical test.

By order of the Committee.

WILLIAM HAMILTON, *Actuary.*

June 12*th*, 1834.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a Spirit Level, invented by Mr. Henry R. Campbell, of Philadelphia, Report:—

Considerable difficulty has hitherto been experienced in rail-road field operations, from the want of an instrument which might combine the common spirit level with a correct circle for laying off angles, with sufficient accuracy for the tracing of curves, and which, at the same time, would admit of pitching, or inclining the telescope, without the necessity of throwing the parallel plates out of adjustment. In the tracing of curves, the union of these qualities is particularly desirable, the operation having hitherto generally required two separate instruments, viz: the common compass, and the spirit level. The former, besides never being divided with that degree of minuteness which is necessary for a proper execution of the work, allows, through its upright slits, a field of view entirely too large to define the points of curve in a satisfactory manner. Mr. Campbell's improved level obviates these disadvantages in a perfect manner. His improvement consists in the *combination* of the common level, with a circle divided into minutes; a screw is attached to one of the Y's, as in the old English levels, by which the telescope may be so inclined as to obtain points of curve on a sloping surface, without throwing the divided circle out of a horizontal position; a compass is so applied, as to be attached and detached at pleasure.

Mr. Campbell's object in requesting a notice of his level, is merely to prevent any other, to whom the same combination may suggest itself, from patenting the same and thereby retarding its introduction into common use.

By order of the Committee.

WILLIAM HAMILTON, *Actuary.*

Aug. 14*th*, 1834.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, Goodspeed & Wiswell's patent "Circular, Vertical, and Angular Sawing and Boring Machine," Report:—

That the machine under consideration is a species of saw-mill, in which, instead of placing the saw or saws upon cross heads, between two bars or rods acting as stretchers, there is a single support for the cross heads in the middle of the moveable frame, and the saws are placed near the extremities of the cross heads, by which arrangement, the saws are left free to operate on planks or boards of any required length or breadth; the central or main support of the saws is sustained by flanges in its upright position, and other convenient flanches receive the cross heads above mentioned.

To use the saws above described for cutting circular segments out of plank, either at right angles to its face, as in the case of the rims of carriage wheels, or at any obliquity, as in that of chair backs, the inventors have employed a quadrant, capable of being adjusted to any required radius, and of lying either horizontal or inclined, according as the rectangular or the oblique section is to be made in the plank. This quadrant is, by means of several separate centres, capable of producing circles of a great variety of radii.

By means of a graduated index and a circular saw, another part of the machine is made to perform the operation of angular sawing, so as to cut from the ends of the felloes of carriage wheels, the requisite sections, in order that they may precisely complete a circle, when the required number is brought into the due position. This graduated index, like the quadrant before mentioned, is adapted to different radii, and to different numbers of felloes to a wheel. The hubs of wheels are bored by another part of the same machine, in which there is a sliding support for the hub, which, for this purpose, is made to rest on an arbor supported by journals, and is then sent forward to be presented to the auger, moving always through the same distance for the same hub, and, of course, boring every hole of the same depth. The auger is placed in supports, which rise and fall at pleasure, in order to "enable the operator to bore at any distance from the table or plane he chooses."

The inventors particularly claim the application of the method of hanging the vertical saws, and the mode of raising and depressing the augers.

The committee have witnessed the performance of a machine of the usual size, and of the above description, and can testify to the celerity and precision with which the constituent parts of a wheel-rim are taken from the plank, the ends cut off, the holes bored for the tenons, and the whole thus made ready for being driven upon the spokes. An advantage of no small moment results from the use of this machine, in the saving of material—it being customary, in many establishments, to cut up into chips all those parts of the plank, which the curved form of the felloes does not allow the axe and adze to separate in a more convenient or useful shape.

The committee cannot doubt that wheelwrights, chairmakers, and others, who have occasion for the operations of circular or angular sawing, would find this machine an important auxiliary in their respective trades.

By order of the Committee.

WILLIAM HAMILTON, *Actuary.*

Aug. 14*th*, 1834.

INTOXICATING HONEY.—Xenophon's account of the intoxicating quality of the honey of Trebizond, which made the ten thousand retreating Greek soldiers under that historian's command mad, has always been considered rather an *indigestible* story. Mr. Abbot, a naturalist now residing at that place, as recently as in December last, (1833) writes home that the honey made in Trebizond "affects those who eat it, as I have myself witnessed, precisely as Xenophon describes. When taken in small quantity it causes violent headache and vomiting, and the unhappy individual who has swallowed it, resembles as much as possible, a tipsy man. A larger dose will completely deprive him of all sense and power of motion for some hours afterwards." This inebriating quality is supposed to depend upon the presence of the exudating juice of the flowers of the *Azalea Pontica*, growing in profusion in that country, of which the bees are quite fond. This one fact does a vast deal towards establishing the perfect veracity of Xenophon, whose relations have often been questioned.—*Scientific Tract and Family Lyceum.*

ZINCOGRAPHY.—It is said that an ingenious French gentleman has discovered a metallic composition, the basis of which is zinc, upon which writing, drawings, &c., can be made with as much facility as on stone, and it is so cheap that it promises to supersede lithography entirely.—*Ib.*

CURIOSITIES OF CAVES.—Sir Philip G. Egerton, in a recent paper on the *ossiferous* or bone-caves which have been discovered of late in the Hartz Mountains and in Franconia, says that he found the bones of pigs, birds, dogs, foxes and ruminantia, in every cave he examined; and fragments of rude pottery in those of Scharzfeld, Baumanns, Hohle, and others. In a cave at Rabenstein, he discovered old coins, and iron household implements of the most uncouth forms. How came such miscellaneous affairs buried in such obscure portions of the world? To what age do they belong?—*Ib.*

FOSSIL WAX OF MOLDAVIA.—Every thing extraordinary seems of late to be drawn from the bowels of the earth. Wax, above all things, we have been taught to regard as the secretion or excretion, it is difficult to say which, of an insect—the honey-bee; but *fossil wax* comes up before our eyes, to show, by the best of all evidence, its actual presence, that it is also elaborated somewhere in the regions below—perhaps in the realms of Pluto. Oil of turpentine, at a high temperature, dissolves it completely. At 177° Fahr., it melts, without suffering any change.—*Ib.*